TITLE OF INVENTION:

Amphibious Dredging Vehicle and Method for Restoring Wetlands Using Same

CROSS-REFERENCE TO RELATED APPLICATIONS:

This application is a continuation-in-part of applicant's United States Patent Application No. 10/349,599, filed January 23, 2003.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT:

Not applicable.

REFERENCE TO SEQUENCE LISTING, TABLE, OR COMPUTER PROGRAM LISTING SUBMITTED ON COMPACT DISK:

Not applicable.

BACKGROUND OF THE INVENTION:

(1) Field of the Invention

The invention relates to amphibious vehicles, particularly to amphibious vehicles for use in dredging, and more particularly to restoring wetlands using amphibious dredging vehicles.

(2) Description of the Related Art

Amphibious vehicles, sometimes called marsh buggies, were first developed about fifty years ago. The early vehicles were often used to transport persons and equipment through marshes for oil-and-gas exploration.

First-generation amphibious vehicles have two engines powering four large hollow wheels. The wheels are made of lightweight steel to provide both buoyancy and durability. Each wheel has deep, lugged cleats for traction.

Second-generation amphibious vehicles incorporate pontoons and track-drive systems. These second-generation amphibious vehicles include two longitudinal pontoons for buoyancy and at least one continuous drive track surrounding each pontoon for drive power. Each drive track includes an endless chain driven by a hydraulic motor through a sprocket, and each chain carries channel-type cleats for traction. These conventional vehicles are common in the art of amphibious vehicles. For example, see United States Patent 5,984,032 to Gremillion et al.

Both first-generation and second-generation amphibious vehicles move in shallow water by gripping the water bottom with their cleats and rolling or tracking forward. (In this patent application "shallow water" means water in which the cleats of a conventional amphibious vehicle can grip the water bottom; and "deeper water" means water in which the cleats of a conventional amphibious vehicle float above the water bottom and cannot grip it.) In deeper water, conventional amphibious vehicles move by paddling the water with their cleated wheels or cleated tracks. The wheels or tracks are driven just as they are on land or in shallow water, and the vehicle moves by the force created by moving the wheels or tracks through the water. These vehicles move through deeper water inefficiently and slowly.

Cutterhead dredges are useful for restoring degraded wetlands. In restoring wetlands, cutterhead dredges can be used to rebuild land in water-covered areas where erosion has occurred. Applicant's U.S. patent application no. 10/349,599, which is incorporated herein by reference, discloses a system and method for restoring degraded wetlands using a cutterhead dredge and other devices.

Cutterhead dredges intended for use in wetlands are commonly mounted either on a floating vessel—typically a boat or a barge—or on a conventional amphibious vehicle. Whether mounted on a floating vessel or on an amphibious vehicle, cutterhead dredges work well in the areas that they can reach. But both floating vessels and conventional amphibious vehicles cause problems when one dredging task is complete and the operator needs to move the dredge to a new location. Floating vessels cannot travel over land; conventional amphibious vehicles travel across water inefficiently and slowly.

Floating vessels are limited to areas where there is enough water to float the particular vessel—preferably without undue risk of running aground. Because wetlands restoration often takes place in a degraded marsh—a combination of land, water too shallow for most vessels, and deeper water—floating vessels simply cannot reach many areas that need to be restored. Further, in many wetlands that need to be restored, cutting a channel for a floating vessel would be expensive and counterproductive.

Unlike floating vessels, conventional amphibious vehicles can travel on land or in shallow water. But in deeper water, where their cleats cannot grip the bottom, conventional amphibious vehicles move so slowly that driving them a substantial distance across deeper water becomes impractical. The user must choose between driving the conventional amphibious vehicle slowly across the deeper water or finding another way—usually transport by vessel or truck—to move the vehicle where it needs to be. When a vessel or truck can be used to transport a conventional amphibious dredging vehicle, the transportation requires substantial additional equipment (and thus substantial additional cost) when compared to the applicant's amphibious dredging vehicle.

Further, many wetlands that need restoring simply cannot be reached conveniently by vessel or by truck. Accessing these areas forces the user of a conventional amphibious vehicle to endure the long, slow, unproductive trip to the dredging area from the closest point of access.

Applicant's invention improves on the prior art by using the pumping capacity of a cutterhead dredge to increase a conventional amphibious vehicle's speed and maneuverability in deeper water. The applicant's amphibious dredging vehicle provides greater speed and maneuverability in deeper water than a conventional amphibious vehicle provides. And using applicant's invention, a cutterhead dredge can be moved across land or shallow water as if mounted on a conventional amphibious vehicle. In sum, when compared to dredges mounted on conventional amphibious vehicles, applicants' amphibious dredging vehicle provides equal performance on land or in shallow water and superior performance in deeper water.

In a degraded marsh that includes land, shallow water, and deeper water that must all be crossed for the dredge to do its work, applicant's invention allows for faster, more efficient, and more convenient restoration than is possible using a dredge mounted on a floatable vessel or on a conventional amphibious vehicle.

Applicant's invention provides an amphibious dredging vehicle with improved mobility in deeper water. In embodiments of applicant's invention in which only a single directable discharge is present, the amphibious dredging vehicle has this advantage when the vehicle is being moved from one dredging area to a second dredging area—with no dredging performed during the trip from the first dredging area to the second. When a single-directable-discharge embodiment of the amphibious dredging vehicle is dredging (actually removing material), the directable discharge normally will be unavailable for propulsion. The directable discharge cannot normally be used for propulsion during material removal because normally the dredging

plan will require the dredged material to be deposited in a particular area by means of piping connected to the dredge discharge. When piping is connected to the directable discharge of an amphibious dredging vehicle that has a single directable discharge, the directable discharge cannot provide propulsion to the amphibious dredging vehicle.

On the other hand, if the amphibious dredging vehicle is equipped with a second directable discharge that is not connected to the dredge cutterhead so as to discharge dredged material, then the second directable discharge may be used for propulsion while the cutterhead is being used to remove and deposit dredged material.

BRIEF SUMMARY OF THE INVENTION:

It is an object of this invention to provide an amphibious dredging vessel that includes one or more of the following: a directable discharge connected to the dredge pump and controlled by a directable-discharge-control means for aiming the directable discharge; a water discharge connected to a water pump and controlled by a water-discharge-control means for aiming the water discharge.

It is an object of some embodiments of this invention to provide a method for restoring wetlands using the amphibious dredging vehicle disclosed herein and optionally using, along with the amphibious dredging vehicle, a system for building up land in a water-covered area as described in applicant's United States application no. 10/349,599, which is incorporated herein by reference.

BRIEF DESCRIPTION OF THE DRAWINGS:

FIG. 1 is a partial side view of an amphibious dredging vehicle according to the invention.

FIG. 2 is a partial top view of an amphibious dredging vehicle according to the invention.

FIG. 3 is a partial rear view of an amphibious dredging vehicle according to the invention.

FIG. 4 is a schematic diagram showing a hydraulic circuit according to the invention.

The invention will be better understood in view of the following description presented with reference to the accompanying drawings:

Both the foregoing general description and the following detailed description are exemplary and explanatory only and do not restrict the invention as claimed.

DETAILED DESCRIPTION OF THE INVENTION

The inventor now moves to a detailed description of an embodiment of an amphibious dredging vehicle 100 according to the invention.

As best seen in Fig. 2, amphibious dredging vehicle 100 has first floatable pontoon 10 and second floatable pontoon 20 with a link disposed therebetween and fixed thereto in conventional fashion, such as by welding or bolting the link to floatable pontoons 10 and 20. In this embodiment, floatable pontoons 10 and 20 are constructed of lightweight and sturdy metal and are equipped with conventional internal baffles, which increase the strength of the pontoons and render the pontoons less likely to lose their buoyancy due to a leak or puncture. The link between the floatable pontoons 10 and 20 may take any convenient and sufficiently sturdy form. In the embodiment depicted, the link takes the form of a conventional metal frame 31 having a

generally flat deck 30 mounted thereon. The deck 30 allows for a convenient mounting point for other components of the invention and for other components of the amphibious dredging vehicle 100. The total width and length of the amphibious dredging vehicle 100 may preferably be selected to allow the amphibious dredging vehicle 100 to be transported by truck.

The front end portions of first floatable pontoon 10 and second floatable pontoon 20 are aligned with the front end portion of deck 30. First floatable pontoon 10 has conventional drive track 12 mounted thereon. Second floatable pontoon 20 has conventional drive track 22 mounted thereon. The pontoons may be constructed of any material that is sufficiently light and durable to allow construction of a sturdy and floatable pontoon; examples include aluminum and steel.

Mounted to the front end portion of the deck 30 is cutterhead 40. Cutterhead 40 may be of any convenient design, including cylindrical or disk-shaped rotating devices or arrays of high-pressure water jets; a cylindrical rotating design is shown here. Also mounted to the deck 30 is dredge pump 50, which is operatively connected to cutterhead 40 in conventional fashion. Dredge pump 50 includes both impeller housing 51 and ten-inch hydraulic pump 52.

Also mounted near the front end portion of deck 30 is control house 32. Control house 32 provides a convenient location for operating the amphibious dredging vehicle. Tank housing 38 includes therein tanks for both diesel fuel and hydraulic fluid. A powerplant in the form of diesel engine 36 provides power to the amphibious dredging vehicle 100 through three separate paths. The powerplant also may take the form of other fuel-air engines, electric motors, or other power-providing mechanisms. Diesel engine 36 powers pump 37A that pressurizes hydraulic fluid in a conventional hydraulic circuit 137, which includes conventional tubing linking the hydraulic pump 37A to all devices that are powered by the hydraulic circuit 137. Fig. 4 is a

schematic diagram showing that the hydraulic circuit 137 links hydraulic pump 37A to first hydraulic drive motor 14, second hydraulic drive motor 24, hydraulic drive motor 53 mounted adjacent to dredge pump 50, hydraulic drive motor 91 mounted adjacent to water pump 90, hydraulic ram 63, and hydraulic ram 99; the devices are linked in conventional fashion by pairs of hydraulic lines.

In one path, the hydraulic circuit 137 powers the drive tracks, which allow the amphibious dredging vehicle to track forward across land or shallow water. The hydraulic circuit 137 powers a first track-driving means in the form of a first hydraulic drive motor 14 and second track-driving means in the form of second hydraulic drive motor 24. The first hydraulic drive motor 14 drives first drive track 12 through a chain and sprocket 16. The second hydraulic drive motor 24 likewise drives second hydraulic drive motor 24 drives second drive track 22 through a chain and sprocket 26. The claimed first track-driving means and the claimed second track-driving means do not have to be hydraulic drive motors. Instead, the claimed first track-driving means and the claimed second track-driving means may take the form of any device capable of providing sufficient motive power, including electric motors and mechanical transmissions driven either by a central powerplant or by individual powerplants for each track.

In the second path, the hydraulic circuit 137 provides power to a dredge-pump-driving means in the form of hydraulic drive motor 53 that drives dredge pump 50. When the dredge is being moved across deeper water from one dredging site to another, dredge pump 50 may be used to pump water through directable discharge 60 to move the amphibious dredging vehicle 100. By controlling the aim or orientation of directable discharge 60, the operator may control the direction of the amphibious dredging100 vehicle when the dredge pump 50 is being used to move the amphibious dredging vehicle 100 through water. The claimed dredge-pump-driving

means does not have to be a hydraulic drive motor. Instead, the claimed dredge-pump-driving means may take the form of any device capable of providing sufficient motive power, including electric motors and mechanical transmissions driven either by a central powerplant or a powerplant dedicated to driving the dredge pump 50.

The rear end portion of the deck 30 is disposed opposite the front end portion of the deck 30. Mounted near the rear end portion of the deck 30 is directable discharge 60, which is more easily seen in Fig 3. Directable discharge 60 is made from conventional sturdy, flexible tubing such as reinforced rubber or flexible PVC pipe and is joined to discharge plumbing 70 by flange 72 or by another conventional joint. Directable discharge 60 is operatively connected to cutterhead 40 and dredge pump 50 by conventional discharge plumbing 70, which preferably is aluminum pipe with a diameter between 4 inches and 10 inches. Directable discharge 60 is made from flexible material that allows the directable discharge 60 to be aimed as needed to provide the desired propulsion to the amphibious dredging vehicle 100. The directable-discharge-control means takes the form of ring 62 secured to directable discharge 60 and operatively connected to hydraulic ram 63, which is in turn attached to second floatable pontoon 20. The hydraulic ram 63 may be controlled to select and maintain the desired aim of the directable discharge 60. The directable-discharge-control means also may take the form of any of several known devices capable of aiming directable discharge 60—for example, hydraulic cylinders, cables, links, electric motors, solenoids, and other devices operatively connected to directable discharge 60 and capable of changing and maintaining the aim of the directable discharge 60 in the desired orientation.

In the third path, the hydraulic circuit 137 provides power to a water-pump-driving means in the form of a hydraulic drive motor 91 that drives water pump 90. Water pump 90 may be

used to pump water from water intake 94 through water discharge 92 to move the amphibious dredging vehicle 100. By controlling the aim or orientation of water discharge 92, the operator may control the direction of the amphibious dredging100 vehicle when the water pump 90 is being used to move the amphibious dredging vehicle 100 through water. The claimed water-pump-driving means does not have to be a hydraulic drive motor. Instead, the claimed water-pump-driving means may take the form of any device capable of providing sufficient motive power, including electric motors and mechanical transmissions driven either by a central powerplant or a powerplant dedicated to driving the water pump 90.

The rear end portion of the deck 30 is disposed opposite the front end portion of the deck 30. Mounted near the rear end portion of the deck 30 is water discharge 92, which is more easily seen in Fig 3. Water discharge 92 is operatively connected to water intake 94 and water pump 90 by conventional water-discharge plumbing 96, which preferably is aluminum pipe with a diameter between 4 inches and 10 inches. Water discharge 92 may be made from conventional sturdy, flexible tubing such as reinforced rubber or flexible PVC pipe and is joined to water-discharge plumbing 96 by flange 98 or by another conventional joint. Water discharge 92 is made from flexible tubular material that allows the water discharge 92 to be aimed as needed to provide the desired propulsion to the amphibious dredging vehicle 100. The water-discharge-control means is operatively connected to water discharge 92. The water-discharge-control means may take the form of ring 97 secured to water discharge 92 and operatively connected to hydraulic ram 99, which is operatively connected to ring 97 and attached to second floatable pontoon 20. Ring 97 and hydraulic ram 99 operate in the same manner as ring 62 and hydraulic ram 63 described above. Likewise the water-discharge-control means may take the same forms as the directable-discharge-control means described above. Note that in Fig. 1 water pump 90,

water discharge 92, and water intake 94 are shown, but associated hardware such as ring 97, flange 98, and hydraulic ram 99 are omitted from Fig. 1 for clarity; these items appear in Fig. 2 and Fig. 3.

Fig. 1 shows several optional components not previously discussed. Winch 34 is attached to deck 30. Cable 35 is wound onto winch 34. Cable 35 then passes through dredge pulley 37 and is attached to cutterhead 40. Winch 34 thus can raise and lower cutterhead 40 as desired. Overhead frame 80 provides a mounting point for dredge pulley 37. Overhead frame 80 also provides guide-wire pulleys 82 and 84, which attached to guide wire 86. Guide wires sometimes are used in dredging to provide a reference grid for dredging operations. Dredge pulley 37, overhead frame 80, guide-wire pulleys 82 and 84, and guide wire 86 are omitted from the other figures for clarity.

The amphibious dredging vehicle can be used for building up land in a water-covered area in combination with the system and method that the applicant described in his application No. 10/349,599, filed January 23, 2003, of which this application is a continuation-in-part.